Design and implementation of high efficiency non-isolated bidirectional zero voltage transition pulse width modulated DC-DC converters

Abstract

This paper describes the design and implementation of zero voltage transition (ZVT) pulse width modulated (PWM) bidirectional buck–boost converter. The simplicity of the control and the reduction of voltage and current stresses on the main switches are the main features of the proposed converter. The additional component of the converter consists of two auxiliary switches and coupled inductors. They provide a zero voltage switching condition for all switching elements regardless of the power flow direction, making the energy conversion highly efficient. The calculated efficiency of the suggested converter is more than 96% at full load in both buck and boost modes. In addition, the same auxiliary circuit can be used in other basic non-isolated bidirectional converters such as Cuk, Sepic/Zeta, buck–boost/buck–boost and cascade buck–boost converters to provide soft switching. A 100 W prototype of the proposed converter is implemented. The simulation and experimental results are found closely comparable and confirm the effectiveness of the proposed method.